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10/566,476	01/31/2006	Kazuhiro Murata	0234-0507PUS1	5098

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EXAMINER	
SULTANA, NAHIDA	

ART UNIT	PAPER NUMBER
1791	

NOTIFICATION DATE	DELIVERY MODE
07/09/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/566,476	MURATA ET AL.	
	Examiner	Art Unit	
	NAHIDA SULTANA	1791	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 February 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) *24-31* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 January 2006* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *04/28/2006; 01/31/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of claims 1-24 in the reply filed on 03/25/2009 is acknowledged.

Drawings

The drawings are objected to because Fig. 8. is not clear, it is hard to understand what is actually depicted in this figure.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3-9, 12, and 23 are rejected under 35 U.S.C. 102(e) as being anticipated by Hasei (US Publication 2005/0042320 A1).

For claim 1, Hasei teaches:

A method of producing a three-dimensional structure ("device, method of manufacture thereof, manufacturing method for active matrix substrate electo-optical apparatus and electronic apparatus" abstract), comprising the steps of: arranging a substrate close to a tip of a needle-shaped fluid-ejection body (Example Fig. 1. item 1 ("nozzle head"), p("substrate"); and Figs. 2, 3A-3B, paragraph [0057]), having a fine diameter ("diameter on the micrometer" paragraph [0010]), supplied with a solution ("material" paragraph [0058-0061]) ; ejecting a fluid droplet having an ultra-fine diameter toward a surface of the

substrate (paragraph [001]), by applying a voltage having a prescribed waveform to the needle-shaped fluid-ejection body ("method imparts an electric charge to the material by using an electrification electrode" paragraphs [0064, 0074, 0080]); making the droplet fly and land on the substrate (paragraph [0084]) ; and solidifying the droplet after the fluid droplet is landed on the substrate ("material disposition step and immediate dry" paragraphs [0104-0106]).

Claim 3, Hasei further teaches: wherein an electric field is focused at the top of a three-dimensional substance formed of the solidified substance of the droplet (paragraph [0116]), and wherein the three-dimensional substance is grown by stacking the subsequent flying droplet on the top of the three-dimensional substance (example fig. 6c).

Claim 4, it is inherent that wherein a cross-sectional diameter of the three-dimensional structure is controlled by a ***volatile property*** of the droplet ejected from the needle-shaped fluid- ejection body, since similar material is used such as metal and solvents ("silver compounds" and "alcohol" see paragraphs [0058-0061]).

Claim 5, Hasei further teaches: wherein a **temperature** of the substrate is controlled in that the previously landed droplet on the substrate is volatilized to be hard enough for the subsequent droplet stacked thereon ("immediate drying step" paragraphs [0104], and "heating treatment" paragraphs [0116-01118], "bank formation" paragraph [0084]).

Claim 6, Hasei further teaches: wherein a **surface temperature of the substrate is controlled by at least one heating means** selected from the group consisting of a Peltier element, an electric heater, an infrared heater, a heater using fluid such as an oil heater, a silicon rubber heater, and a thermistor, that is fixed to the substrate or a substrate supporting body (**"hotplate or electric heating"** paragraph [0116], and "additional possible heating" paragraph [0117-0118]).

For claim 7, Hasei further teaches: wherein a surface temperature of the substrate is controlled in a range of from room temperature to 100°C ("in addition, in the case that a substrate such as plastic is used, preferably the temperature is greater than or equal to room temperature and equal to or less than 100 oC" paragraph [0123]).

Claim 8, Hasei further teaches: wherein the fluid is a solution containing metal particulates ("silver compound or silver oxide" "using metal particles including any one among, for example gold, silver, copper, palladium, and nickel" paragraph [0058-0059].

Claim 9, Hasei further teaches: wherein the fluid is a polymer solution ("conducting polymers" paragraph [0059]).

Claim 12, Hasei further teaches: wherein the fluid is a low molecular weight compound solution (paragraph [0061]).

Claim 23, Hasei further teaches: wherein the steps are conducted in an atmosphere having a vapor pressure of the fluid lower than a saturated vapor pressure of the fluid (paragraph [0010]).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-6, 8-13, 23-24 are rejected under 35 U.S. C. 103(a) as being unpatentable over Danforth et al. (US patent No. 5, 997, 795) in view of Sachs et al. (US Patent No. 5, 807, 437).

For claim 1, Danforth et al. teach:

A method of producing a three-dimensional structure ("process for forming photonic bandgap structures" abstract), comprising the steps of: arranging a substrate close to a tip of a needle-shaped fluid-ejection body (example Fig. 3. Items 14 ("print head"), 19 ("substrate")), having a fine diameter ("nozzle sizes" col. 10. lines 30-40), supplied with a solution ("material" Col. 6. lines 15-40); ejecting a fluid droplet having an ultra-fine diameter toward a surface of the

substrate (Col. 10. lines 65-67, col. 11. lines 40-60), making the droplet fly and land on the substrate (example fig. 3, Item 100); and solidifying the droplet after the fluid droplet is landed on the substrate (Col. 11. lines 40-60).

However, Danforth et al. do not teach: applying a voltage having a prescribed waveform to the needle-shaped fluid-ejection body.

In the same field of endeavor, three dimensional printing system, Sachs et al. teach: applying a voltage having a prescribed waveform to the needle-shaped fluid-ejection body ("voltage applied to charging cells" Col. 4. lines 10-25), forming three dimensional printing pattern (example Fig. 1 & 2, col. 3. lines 25-40), for the benefit of controlling the landing position of the droplet (Col. 4. lines 40-50).

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify the process of making three dimensional structure as taught in Danforth et al. with having electrostatic charge applied to the fluid, as taught in Sachs et al., for the benefit of controlling the landing position of the droplet at a target position (Col. 4. lines 40-50).

Claim 2, Danforth et al. teach: wherein an electric field is focused at a the substrate (col. 10. lines 50-65), and a subsequent droplet is stacked on said solidified substance ("building up multiple layer" Col. 11. lines 40-55).

However, Danforth et al. do not teach: wherein an electric field is focused at a **solidified substance** formed of previously landed droplet. However, there are some of the charges are applied to the substrates are indirectly transferred to

the solidified substance, since voltage current is facilitating the separation device 100 from the substrate (col. 10. lines 50-60).

Claim 3, Danforth et al. teach: wherein the three-dimensional substance is grown by stacking the subsequent flying droplet on the top of the three-dimensional substance (col. 11. lines 40-60).

However, Danforth et al. do not teach: wherein an electric field is focused at the top of a three-dimensional substance formed of the solidified substance of the droplet.

In the same field of endeavor, three dimensional printing systems, Sachs et al. teach: wherein an electric field is focused at the top of a three-dimensional substance formed of the solidified substance of the droplet ("voltage applied to charging cells" Col. 4. lines 10-25), forming three dimensional printing pattern (example Fig. 1 & 2, col. 3. lines 25-40), for the benefit of controlling the landing position of the droplet (Col. 4. lines 40-50). The previous combination motivation remains as applied.

For claim 4, Danforth et al. teach having similar material and solvent: ("particular material may be selected from the group consisting of ceramic materials, elemental metals, metal alloys..." col. 6. Lines 25-40, Col. 8. lines 20-35, "size of the largest particles in the distribution should be substantially smaller than the diameter of the dispensing nozzle" col. 6. lines 60-6), and the three-dimensional structure is controlled by a volatile property of the droplet ejected

from the needle-shaped fluid- ejection body ("material" col. 6. lines 25-40; "material dispersed is adheres to the previous layer" col. 12. lines 25-30).

For claim 5, Danforth et al. teach wherein a temperature of the substrate is controlled in that the previously landed droplet on the substrate is volatilized to be hard enough for the subsequent droplet stacked thereon (col. 10. lines 50-60).

Claim 6, Danforth et al. further teach: wherein a surface temperature of the substrate is controlled by at least one heating means selected from the group consisting of a Peltier element, an electric heater, an infrared heater, a heater using fluid such as an oil heater, a silicon rubber heater, and a thermistor, that is fixed to the substrate or a substrate supporting body ("voltage current applied to heat substrate" Col. 10. lines 55-60).

Regarding Claim 8, 9, 10, and 11, Danforth et al. further teach: wherein the fluid is a solution containing metal particulates (Col 6. lines 25-40), wherein the fluid is a polymer solution (Col. 7. lines 35-50, col. 8. lines 20-35), wherein the fluid is a solution containing ultra-fine ceramic particles ("ceramic" and "size of particles" col. 6, lines 25-40 & 60-67), fluid is sol-gel of ceramic ("ceramic" Col. 6. lines 25-40 & 60-67).

For claims 12-13, Danforth et al. further teach: wherein the fluid is a fluid containing at least one solution selected from the group consisting of a solution containing metal particulates, a polymer solution, a solution containing ultra-fine ceramic particles, a sol-gel solution of ceramics, and a low-molecular weight compound solution (Col. 6. lines 25-40).

For claims 23-24, Danforth et al. further teach: wherein the dielectric constant of the fluid to be ejected is 1 or more ("low dielectric material" Col. 1. lines 60-67), and wherein the steps are conducted in an atmosphere having a vapor pressure of the fluid lower than a saturated vapor pressure of the fluid ("holes may be filled with air or vacuum" col. 1. lines 60-67).

Claims 7, and 14-22 rejected under 35 U.S.C. 103(a) as being unpatentable over Danforth et al. (US Patent No. 5, 997, 795) in view of Sachs et al. (US Patent No. 5, 807, 437) and in further view of Hayes (US Patent No. 6, 114, 187).

For claim 7, Danforth et al. teach: producing a three dimensional structure, arranging a substrate close to a tip of a needle-shaped fluid-ejection body (example Fig. 3. Items 14 ("print head"), 19 ("substrate")), however failed to teach: wherein a surface temperature of the substrate is control in a range from room temperature to 100 ^{o}C.

In the same field of endeavor, method for preparing a chip scale package and product produced by the method, Hayes teaches: wherein a surface temperature of the substrate is controlled in a range of from room temperature to 100 o C (col. 10. lines 10-30).

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify the method of producing three dimensional

structure as taught by Danforth et al. and Sachs et al. with having to control substrate temperature at a specific range, as taught in Hayes, for the benefit of solidifying the droplet faster, since substrate temperature affect the freezing of the droplet (col. 10. lines 10-25).

Regarding claims 14-16, Danforth et al. teach distribution of the droplet substantially smaller than the diameter of the dispensing nozzles outlet as to avoid any bridging effect (col. 6. lines 60-65) and nozzle size shape depends on the application of product being made (col. 10. lines 30-40), however fail to teach specifically: wherein a diameter of the ejected droplet is 15 micrometer or less, wherein a diameter of the droplet is 5 micrometer less, wherein a diameter of the droplet is 3 micrometer or less.

In the same field of endeavor, method for preparing a chip scale package and product produced by the method, Hayes teaches: wherein a diameter of ejected droplet is 15 micrometer or less (col. 8. lines 15-25), wherein a diameter of the droplet is 5 micrometer or less (col. 8. lines 15-25), and wherein a diameter of the droplet is 3 micrometer or less (col. 8. lines 15-25).

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify the diameter of the droplet as taught by Danforth et al. with having specific diameter of the droplet, as shown in Hayes for the benefit of having device filled via cone shaped solder column 28 in which the vias act as mold to define the column (col. 8. lines 15-25), and specific use in integrated circuit chip (col. 8. lines 24-27).

For claims 17, 18, and 19, Danforth et al. teach: deposited layer solidify rapidly (col. 12. lubes 40-55). However, Danforth et al. fail to teach specifically: wherein a time required for the droplet to be dried and solidified is 2 seconds or less; wherein the time required for the droplet to be dried and solidified is 1 second or less; wherein the time required for the droplet to be dried and solidified is 0.1 second or less.

In the same field of endeavor, Hayes et al. teach: heating substrate using to about 75 ^{o}C (Col. 5. lines 50-55), for the benefit of freezing the metal alloy which is typically at 220 ^{o}C (col. 5. liens 50-55).

It would have been obvious to one having the ordinary skill in the art at the time of the invention to optimize the substrate temperature, and jetting material temperature as taught in Hayes et al. for the benefit solidifying the droplet at specific amount of time, since it has been held that discovering the optimum value of a result effective variable involves only routine skill in the art. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

Regarding claims 20, 21, and 22, Danforth et al. fail to teach: wherein a flying speed of the droplet is 4 m/sec or more; wherein the flying speed is 6 m/sec or more; wherein the flying speed is 10 m/sec of more.

In the same field of endeavor, method for preparing a chip scale package and product produced by the method, Hayes teaches: wherein a flying speed of the droplet is 3 m/sec (col. 10. lines 25-30), and teaches speed of the jetting device is varied with the applied voltage applied to the print-head (col. 5. lines 25-30).

However, Danforth et al. do not teach having flying speed at 4m/sec or more, or 6 m/sec of more.

It would have been obvious to one having the ordinary skill in the art at the time of the invention to optimize the voltage applied to the print-head (col. 5. lines 25-30) in Hayes for the benefit of getting specific speed of the droplet, since it has been held that discovering the optimum value of a result effective variable involves only routine skill in the art. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

US Patent No. 5, 121, 329.

US Publication: 2005/0012247 A1; 2002/0054912.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NAHIDA SULTANA whose telephone number is (571)270-1925. The examiner can normally be reached on Mon- Fri 7:30 Am - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Del Sole can be reached on 517-272-1130. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NS

/Joseph S. Del Sole/
Supervisory Patent Examiner, Art Unit 1791